



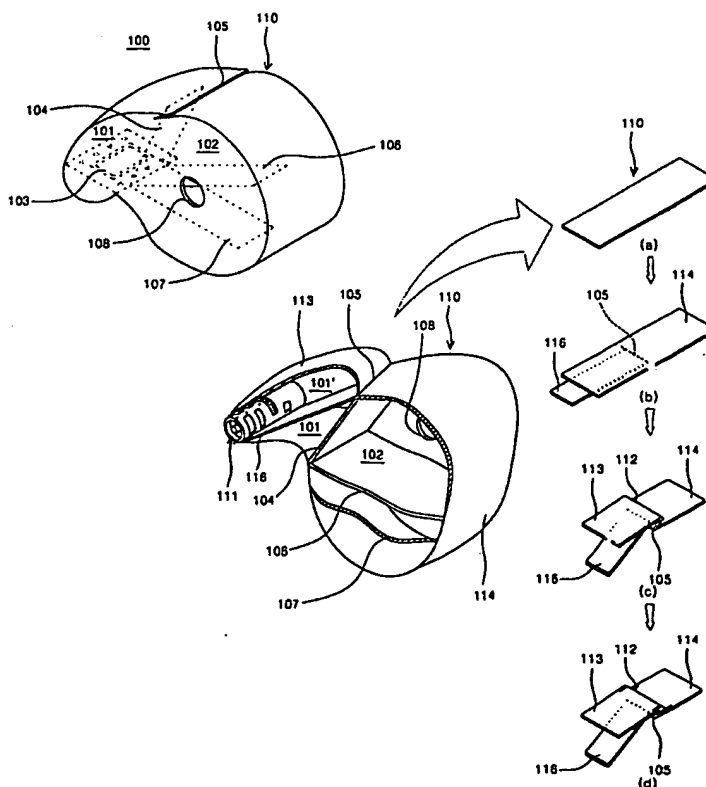
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(54) Title: DEPLOYING DIRECTION CONTROLLABLE AIRBAG STRUCTURE

(57) Abstract

An airbag structure is constructed to form an inlet chamber (101) for relieving the instant gas pressure upon the initial deployment and a tether (104) for controlling the deploying direction of an airbag cushion (110) and a bubble chamber (102), including a plurality of chambers, in which the chambers include, respectively, a tether (106, 107) coupled to a tuck or a pleat that is folded or sewed in turn at a predetermined height to the airbag cushion (110).



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DEPLOYING DIRECTION CONTROLLABLE AIRBAG STRUCTURE

Background of the Invention

The invention is related to providing an airbag to be supposed to restrain
5 its deploy development in a desirable direction, and particularly, to an airbag
structure for controlling the deploying development direction such as the upper
direction or other directions to protect a passenger in a vehicle in emergency crash
conditions.

10 Prior Art

In general, an airbag system has been mounted in a vehicle to protect
passengers upon the accident of a head-on or rear collision. The airbag system is
typically operated in a manner to inflow inflation gas momentarily generated by
a gas generator in response to a crash sensor of known variety into an airbag
15 during the crash, thereby restraining the passengers from being thrust against the
vehicle structure or parts.

Such like airbag systems are supposed to have their installment positions
and the configurations different from each other according to the passenger seat,
as if it has been used as a driver restraint part by being mounted in a steering
20 wheel. For example, a passenger airbag system is mounted between the instrument
panel and dash board, this type of which is further classified into low, middle and
top ones, The top type is mounted on the bottom portion of the instrument panel
to deploy the airbag from the lower position to the upper position, the middle type
is installed in the middle portion of the instrument panel to deploy the airbag
25 toward the front of the passenger and the low type on the lower portion of the
instrument panel to deploy the airbag from the upper position to the lower

position, thereby retraining the passenger.

It is well-known to skillful persons in this field that the various airbag systems make serious effects on the passenger's safety based on how to restrain the occupant on the seat. Therefore, the airbag system, particularly an airbag is requested to differentiate its configuration and shape in order to effectively protect the passenger according to the installation position thereof, and the configuration of a gas generator should be also changed. Considering these points, it is known that airbags should be changed in their configuration.

Herein, explaining an example of an airbag, the airbag system including the exemplified airbag is mounted below the instrument panel with a gas generator as shown in Figs. 1 and 2.

The airbag system as shown in Fig. 1A includes a gas generator 14 positioned in the space, which is wrapped around a hood 2 fixed to a cross member not shown, a dash panel 4 fixed to the cross member and an instrument panel 6, and an airbag cushion 18 coupled to the gas outlet portion of the gas generator 14. On both upper sides of the instrument a front glass 8 is installed by pillars not shown. The gas generator 14 is mounted in a housing 12 properly fixed on the dash panel 4 and includes an inflator electrically connected to an electronic control unit (ECU). An expanding portion 12a is formed to be extended from the upper portion of the housing 12, a diffuse 16 is positioned in the expanding portion 12a and includes a plurality of outlet holes formed thereon and an airbag cushion 18 is fixed on the upper portion of the diffuse 16 in a deflated, folded condition. The airbag cushion 18 is typically inflated by the gas pressure from the gas generator 14 so as to protect a passenger from secondary impact upon the crash and includes a gas inlet opening or mouth 18a and a bubble portion 18b sewn to each other. The airbag cushion 18 includes a discharging hole 18c formed

on both sides to prevent the transferring of an excessive gas inflation pressure to the passenger in the procedure of the gas pressure inflation. The airbag cushion 18 further includes tethers 19 and 19a longitudinally formed in turn in the predetermined length and width to restrain its inflation and deploy in a
5 predetermined direction, exactly.

Therefore, the airbag system enables a signal from the ECU to be applied to the gas generator 14, so that the airbag cushion 18 receives the gas pressure generated by the gas generator 14, instantly, and then the tethers 19 and 19b
10 inflow the inflation gas along their lengthwise direction therein to restrain the passenger.

An airbag is normally put under an excessive gas inflow situation at the initial inflation. To it, the airbag cushion 18 is first expanded and runs up against the windshield 8 thereby to stop the further advancement in a moment as shown in Fig. 2A. Then, the bubble portion 18b is deployed along the windshield 8
15 toward the inner portion of a vehicle as shown in Fig. 2B and inflated based on the gas inflowing guide of the tethers 19 and 19a as shown in Fig. 2C.

But, the airbag has a problem in restraining the passenger, because the serious eccentricity to the blowing out direction of gas happens.

In light of this problem, it is very desirable if the passenger or driver is
20 restrained in an optimum state regardless of the place where the airbag is mounted. To it, to aim at restraining the deploying direction of the airbag on time in a predetermined direction is a very important requirement.

Typically, U. S. Patent No. 5,382,048 discloses technical contents in that an airbag is deployed lower and more toward the vehicle occupant's midsection
25 or torso in a limited sense, but is mostly related to a fold configuration for an airbag.

A folded airbag cushion disclosed in the patent includes a few folds to deploy lower toward the midsection of the passenger. As the airbag cushion deployment deploys, pressurized gas stored therein pushes open each fold one after another until the airbag cushion is fully deployed. And, since the folds are
5 difficult for the inflator pressurized gas to push open, it reduces the velocity of the cushion as it unfolds.

The fold configuration of the airbag cushion includes an upper pleat and a lower pleat even in a lengthwise to tuck the center of fabrics toward the mouth thereof and then form a roll by the reference of the roll, in which the upper pleat
10 is longer than the lower pleat.

But, because the airbag cushion is constructed to determine the deployment direction according to a sewing method of the pleat, it causes the eccentricity that is escaped from the adjusted curvature as the pressurized gas blows out in a right angle direction. In other words, the airbag cushion is subjected to be inevitable
15 from the eccentricity by the instant gas ejection, even though the predetermined pleats are formed and tucked by the reference of them. Actually, the lower pleat limits somewhat the inflation of the airbag cushion accompanying with the reduction effect of the cushion capacity, but does not control the gas ejection direction following the instant bubble of the airbag cushion roll. Therefore, the
20 patent has a problem in that the gas ejection direction is guided downward, but the substantial situation fails to control the deploying direction.

Considering these points, it is preferable that the gas ejection direction is directly guided in a predetermined direction. Also, it is desirable that an airbag cushion is fordable in a general manner without changing its own inherent shape.

25 Accordingly, an object of the invention is to provide an airbag structure including at least two chambers to adjust an amount of the gas ejection and control

the deployment direction thereof.

Another object of the invention is to provide an airbag structure including at least two chambers in which at least two tethers are mounted therein along a predetermined deploying direction, one side of which is sewed at the same
5 position adjacent to each other and the other side of which is sewed in turn at every predetermined height.

Another object of the invention is to provide an airbag structure including at least two chambers in which at least two tethers are selectively or wholly coupled to a tuck folded in a predetermined length and made of fabrics the same
10 as an airbag cushion and for controlling the deploying direction without changing its own inherent shape.

SUMMARY OF THE INVENTION

According to the invention, an airbag structure comprises a first chamber
15 for controlling the initial deploying direction of an airbag cushion; and a second chamber including a plurality of chambers formed in a desirable deploying direction as the airbag cushion unfolds in a sequence.

In the airbag structure, the first chamber comprises a tether coupled at one side to a tuck which is folded on the upper portion thereof in a predetermined area
20 and other chambers formed in the second chamber, respectively, including a tether coupled to a tuck or a pleat which is folded or sewed in turn in a predetermined height on the airbag cushion.

Therefore, the invention enables an airbag cushion to determine the initial deploying direction and then to control the direction deployed in a sequence,
25 thereby restraining a passenger, effectively.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention now will be described in detail with reference to the accompanying drawings, in which:

Fig. 1 shows a conventional airbag system mounted in a vehicle, in which
5 Fig. 1A is a view illustrating the top mounting state of the airbag system for a passenger of a front seat; and Fig. 1B is a view illustrating the coupling configuration of an airbag and a gas generator.

Fig. 2 shows the operation of the conventional airbag, in which Fig. 2A is a view illustrating the operation that the airbag is deployed toward a windshield
10 in an initial step; Fig. 2B is a view illustrating the operation of the airbag continuously deployed along the windshield; and Fig. 3 is a crosssectional view illustrating the state of the airbag fully deployed close to the windshield.

Fig. 3A is a perspective view illustrating the state of mounting an airbag structure on the mouth of a gas generator according to one embodiment of the
15 invention;

Fig. 3B is a perspective view illustrating the state of coupling an airbag structure with a gas generator according to another embodiment of the invention;
and

Figs. 4A, 4B and 4C are crosssectional views illustrating the deployment
20 operation of an airbag structure according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

According to Fig. 3A, an airbag structure is mounted on the mouth of a gas generator. The airbag structure 100 forms an airbag cushion 110 during the
25 deploying and includes a plurality of chambers, in which the airbag cushion 110 is typically divided into an inlet chamber 101 adjacent to the gas generator and a

bubble chamber 102 for controlling the deploying direction thereof.

The inlet chamber 101 is supposed to properly repress the instant inlet opening 103 of gas from the gas generator. The gas inlet opening 103 is formed on the lower portion of the inlet chamber 101 in a manner to be fixed to an enlarging portion 12a of the gas generator 14, so that gas drawn out from a diffuse 16 is inflowed therein.

A tether 104 is sewed on one side of the lower portion and coupled to a tuck 105, so that the inlet chamber 101 is formed. The tuck 105 is folded lengthwise on the airbag cushion to have a predetermined width and sewed on its both sides, so that both sides are placed in the deploying direction upon the folding of the airbag cushion 110 and elected in a predetermined direction upon the deployment of the airbag cushion 110 to block the movement of the ejection gas, instantly, as well as to control the deploying direction of the airbag cushion 110. The tether 104 is fixed at one side to the outlet bottom of the mouth 103 and at another side to the tuck 105. Therefore, when the airbag cushion 110 is instantly unfolded, the tuck 105 gives an instant resistance force against the gas ejection to the tether 104.

The bubble chamber 102 includes a predetermined number, for example, two tethers 106 and 107 arranged in a lengthwise direction as shown in the drawing. The tethers 106 and 107 are sewed at one side to the lower side of the tether 104 and sewed or coupled at the other side in turn to a pleat formed at a predetermined height along the deploying direction of the airbag cushion 110. Otherwise, the tethers 106 and 107 also may not be sewed at other sides to the pleat. The tethers 106 and 107 can diffuse pressurized ejecting gas through both of their sides into the bubble chamber 102 to control the deploying direction.

On the other hand, the tethers 104, 106 and 107 may include a hole respectively or selectively formed at their predetermined position to have different

areas, if necessary. The tethers 106 and 107 may be coupled at the other side to a tuck formed at a predetermined height along the deploying direction of the airbag cushion 110 like the tether 104 to form a plurality of chambers. Discharging holes 108 are formed at a predetermined position on both sides of the
5 bubble chamber 102 to relieve the gas ejecting pressure. Therefore, the tethers 104, 106 and 107 can control the deploying direction of the airbag cushion 110 upon a crash, effectively.

Referring to Fig. 3B, another airbag structure 100 is illustrated according to the principal of the invention. Herein, the same elements of Fig. 3A are
10 referenced by the same numbers, so their detailed explanations are omitted.

An inlet chamber 101 is somewhat different from that of Fig. 3A in respect of its configuration, but it is simply varied according to the mounting method of the airbag structure 100. The inlet chamber 101 is supposed to receive a gas generator 111. Herein, it is noted that the gas generator 111 should be mounted
15 at a predetermined place in the inner portion of a vehicle along with the inlet chamber 101, for example, fabrics. To it, the airbag structure 100 is made as follows:

Assumed that an airbag cushion 110 forms fabrics a, b, c and d in the procedure of being manufactured, the fabric a is a plain surface. The fabric b has
20 a pleat 105 to form a tuck 113 and an inlet cushion 113 and a bubble cushion 114 by the reference of the pleat 105 as described below. The fabric c includes a fixing portion 116 made of the same fabric as the airbag cushion 110, which is sewed to the pleat 105. The fixing portion 116 is shown in an opened state, but coupled to a rear stud of the gas generator 111 (not shown) to receive the gas generator 111.
25 The fabric d includes the tuck 112 folded in a lengthwise direction to have a predetermined width and sewed along both sides of its folded portions. Therefore,

the fixing portion 116 forms another inlet chamber 101' on the extension line coupled with the inlet cushion 113. Other portions of the airbag cushion 110 not explained are the same as the configuration of Fig. 3A.

The airbag cushion 110 enables the fixing portion 116 to absorb the gas
5 pressure related to the tether 104 in the embodiment of Fig. 3A, firstly, upon the operating of the gas generator 111, but the deployment development of the bubble cushion 114 is similar to that of Fig. 3A.

On the other hand, the airbag structure 100 is folded by the reference of the gas inlet portion, in a manner that the inlet chamber 101 is placed at the lower
10 position in a lengthwise direction with respect to the gas generator and then the bubble chamber 102 is folded in a predetermined manner regardless of its folded shape.

The airbag structure 100 folded and arranged on the gas generator is mounted on the predetermined position of a vehicle, for example, in the
15 instrument panel, and operated as shown in Fig. 4. Herein, it is noted that the mounting place of the airbag structure 100 is not limited to the instrument panel. The same elements are referenced by the same numbers as described above.

As shown in Fig. 4A, when the gas generator 111 mounted between the instrument panel 2 and the dash board 4 is operated, the inlet chamber 101 is
20 deployed in a gas ejecting direction, in a manner that the inlet cushion 113 is bubbled upward and the tether 104 is elected to form the inlet chamber 101 and/or 101'. The inlet chamber 101 is restrained to the space by the pleat or tuck 105 and its deploying direction is controlled by the tether 104, thereby preventing the clashing of the inlet cushion 113 against the windshield 8 and inflowing the
25 ejecting gas toward the front portion in the bubble chamber 102. Then, as shown in Fig. 4B, the pressurized gas inflowed from the inlet chamber 101 is deployed

along the direction that the tethers 106 and 107 are arranged in the bubble chamber 102. Continuously, the airbag cushion 110 is inflated toward a passenger as shown in Fig. 4C.

As described above, the invention classifies a plurality of chambers into
5 their functions to control the deploying direction of an airbag cushion in multiple steps, so that the eccentricity with respect to the gas ejecting direction is corrected in a sequence to restrain the movement toward a desirable portion of a passenger.

WHAT IS CLAIMED IS:

1. An airbag structure comprising:

first chamber for controlling the initial deploying direction of an airbag
5. cushion; and second chamber including a plurality of chambers formed in a
desirable deploying direction as the airbag cushion unfolds in a sequence.

2. The airbag structure according to Claim 1, in which:

the first chamber includes a tether coupled at one side to a tuck which is
10 folded on the upper portion thereof in a predetermined area and the second
chamber includes a plurality of chambers formed therein, in which the chambers
include, respectively, a tether coupled to a tuck or a pleat which is folded or sewed
in turn in a predetermined height to the airbag cushion.

15 3. The airbag structure according to Claim 1, in which:

the tuck is formed between the first and second chambers.

4. An airbag structure comprising:

first chamber including a tether for relieving the instant gas pressure
20 occurring upon the initial deployment of an airbag cushion and a pleat or tuck for
controlling the deploying direction of the airbag cushion, in which the one side of
the tether is coupled to the tuck; and

second chambers, including a plurality of chambers, formed in turn at a
predetermined height in a desirable deploying direction as the airbag cushion
25 unfolds in a sequence.

5. The airbag structure according to Claim 4, in which:

the airbag structure furthermore comprises a fixing portion, one side of which is fixed to a rear stud of a gas generator and other side of which is coupled to a tuck along with a tether.

5

6. The airbag structure according to Claim 4, in which:

the tuck formed between the first and second chambers is folded lengthwise in a predetermined width to have an area and sewed along its both sides lengthwise.

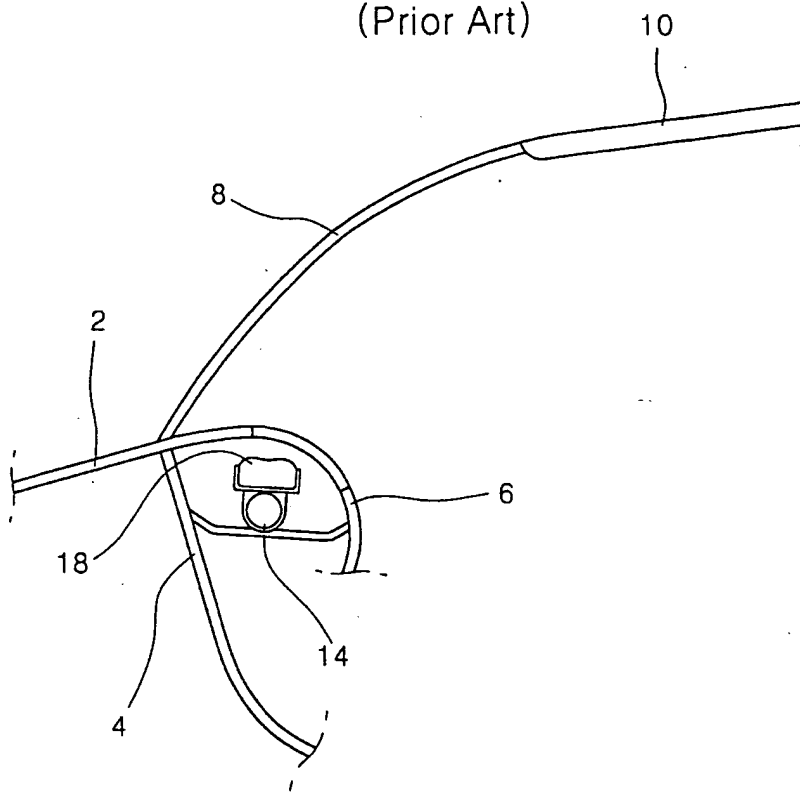
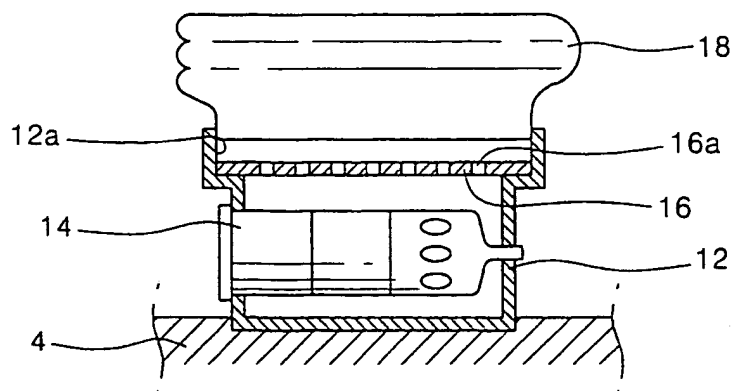
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7. The airbag structure according to Claim 4, in which:

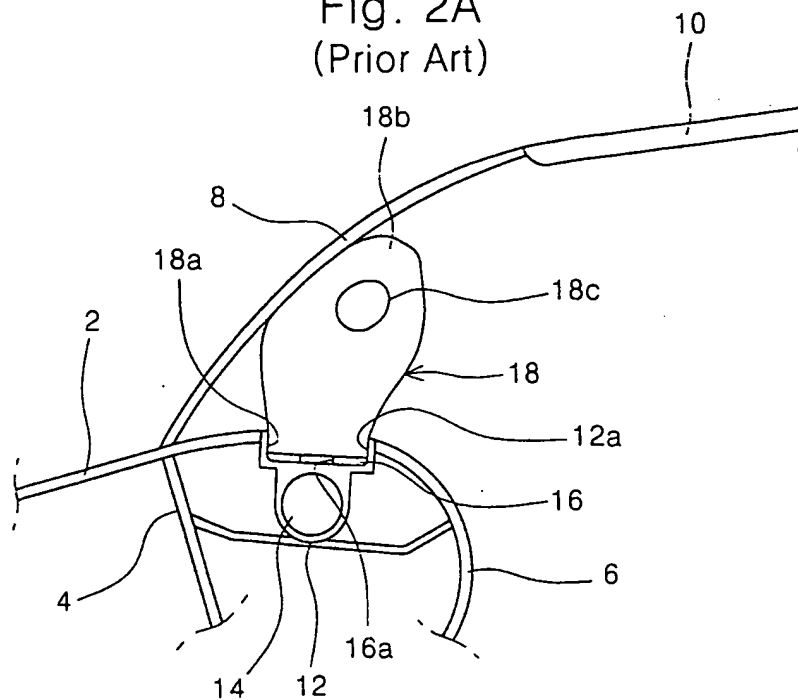
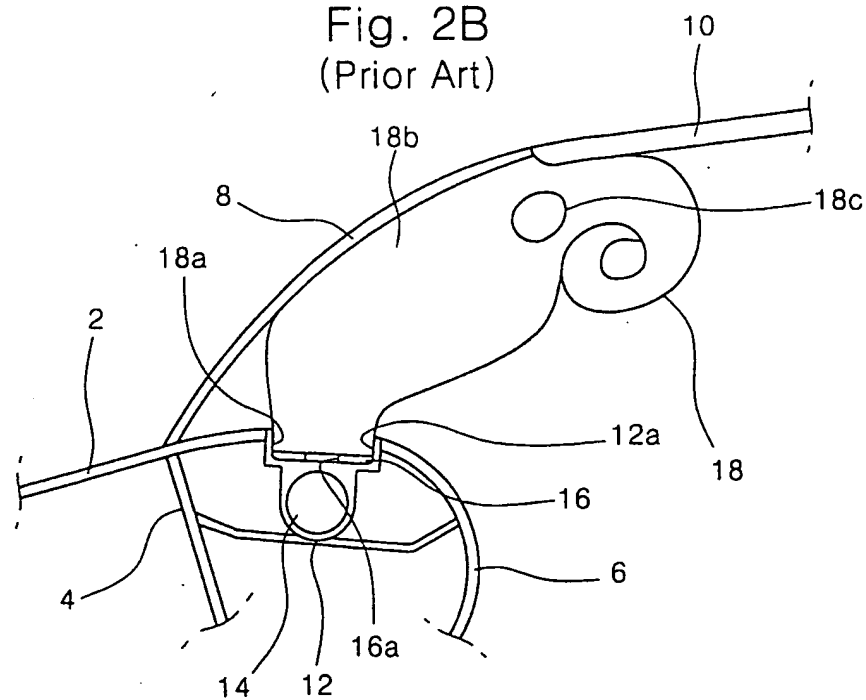
another chamber is formed by the fixing portion instead of the tether of the first chamber.

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Fig. 1A
(Prior Art)Fig. 1B
(Prior Art)

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Fig. 2A
(Prior Art)Fig. 2B
(Prior Art)

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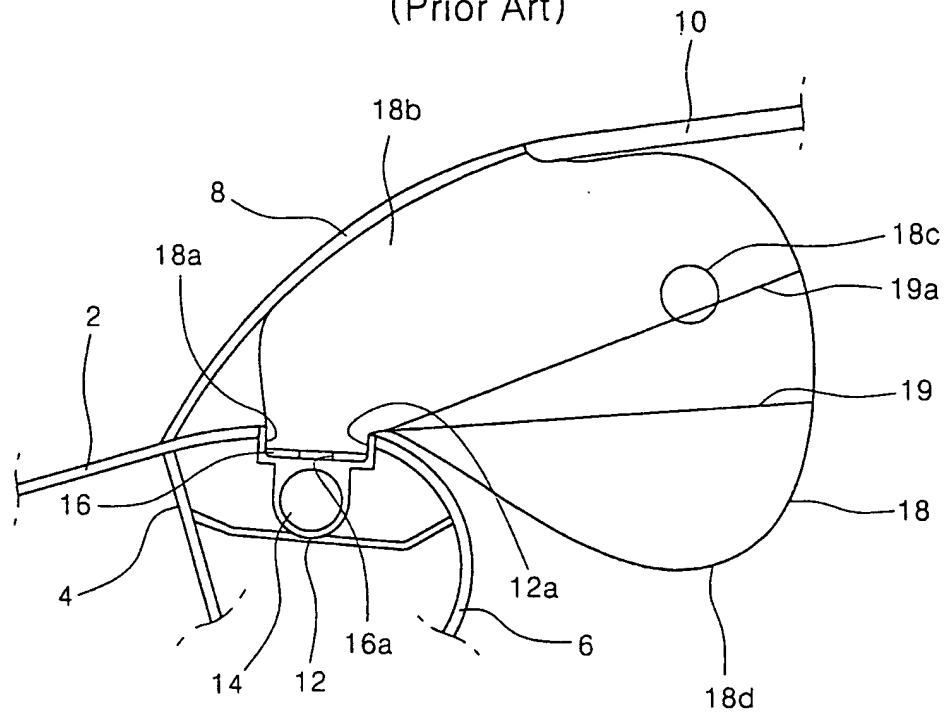
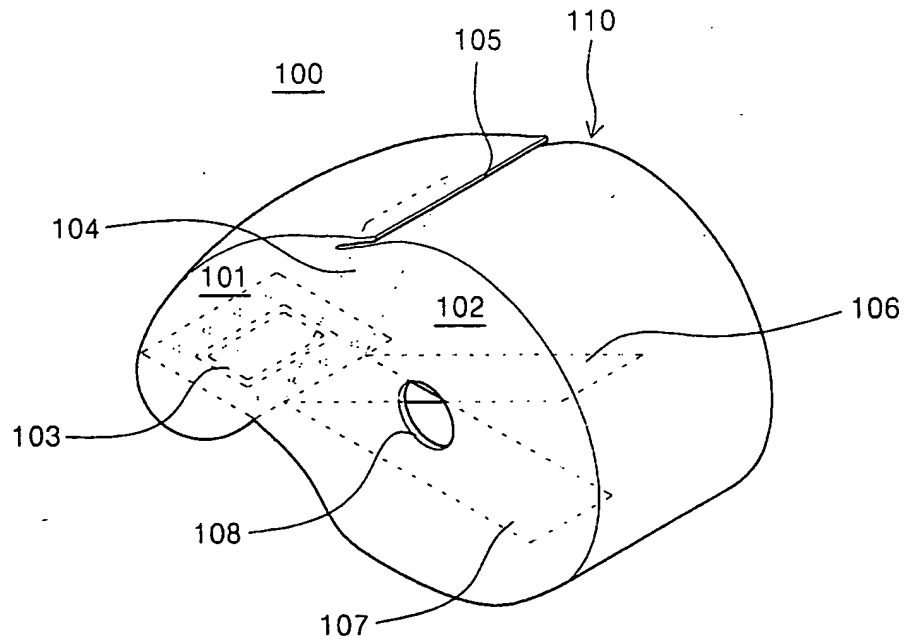
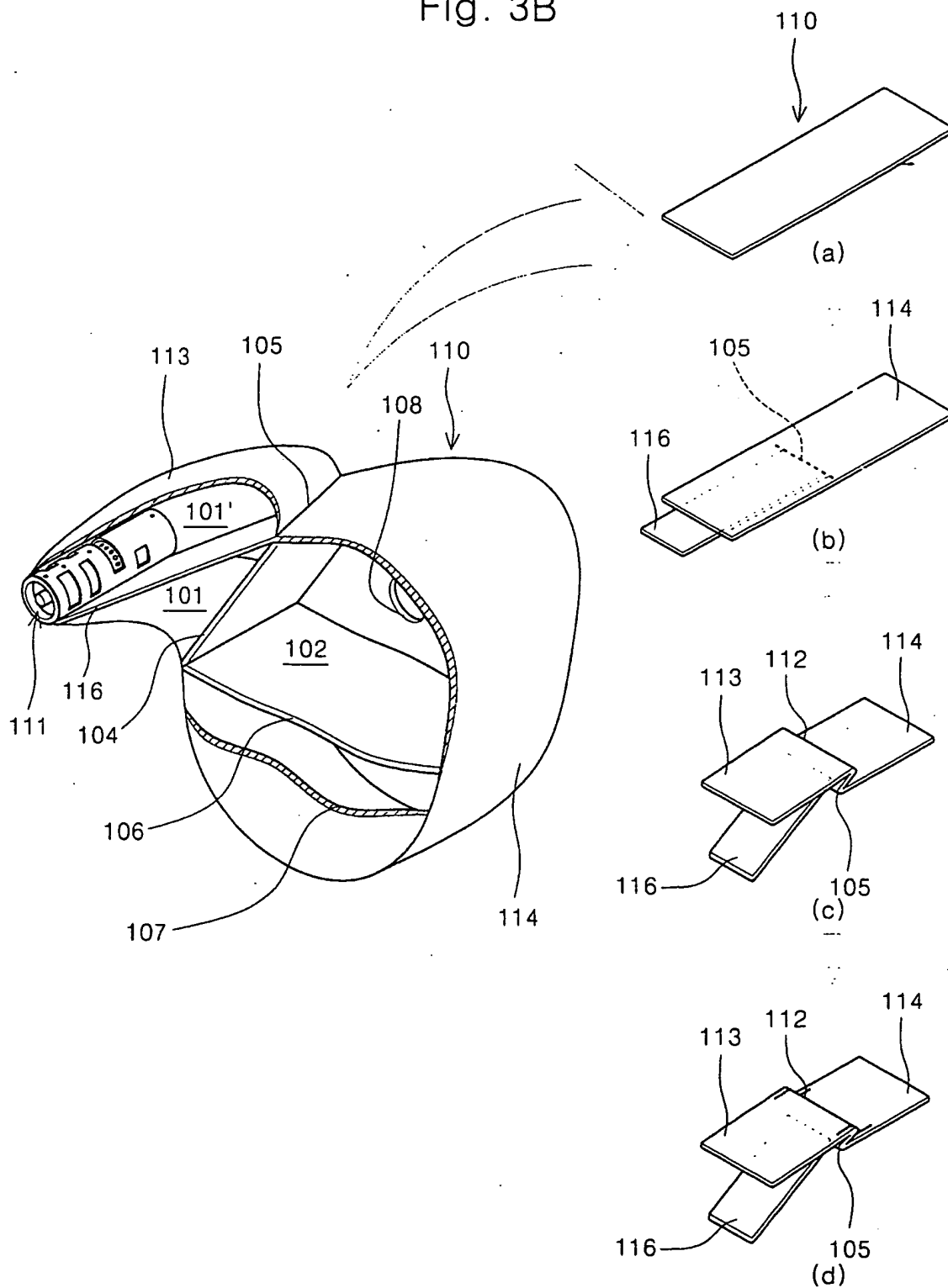
Fig. 2C
(Prior Art)

Fig. 3A



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Fig. 3B



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Fig. 4A

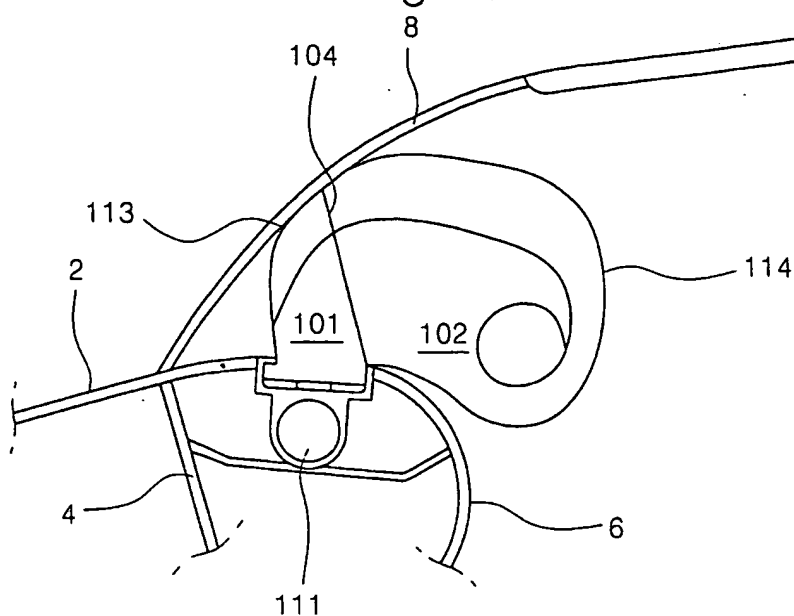
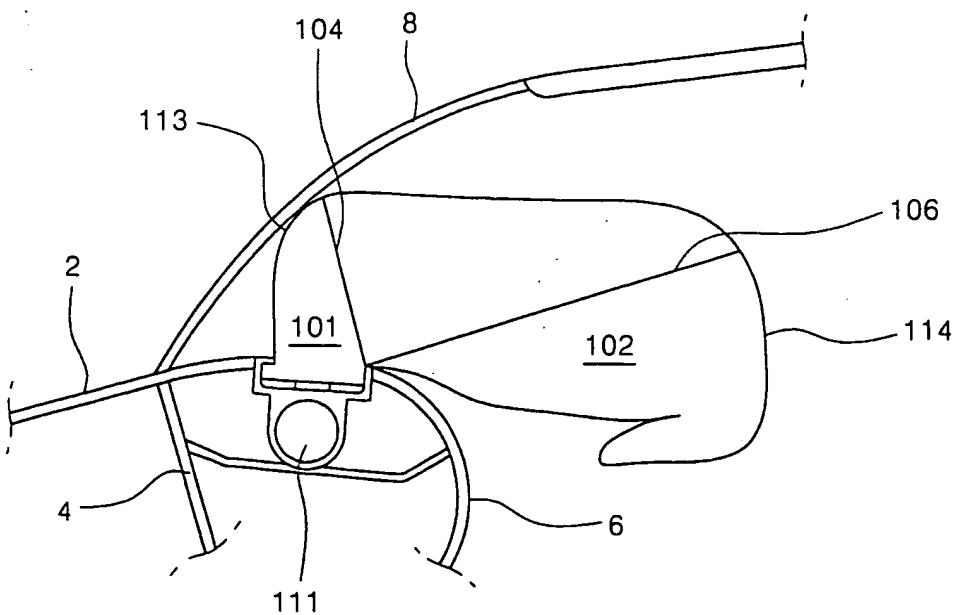
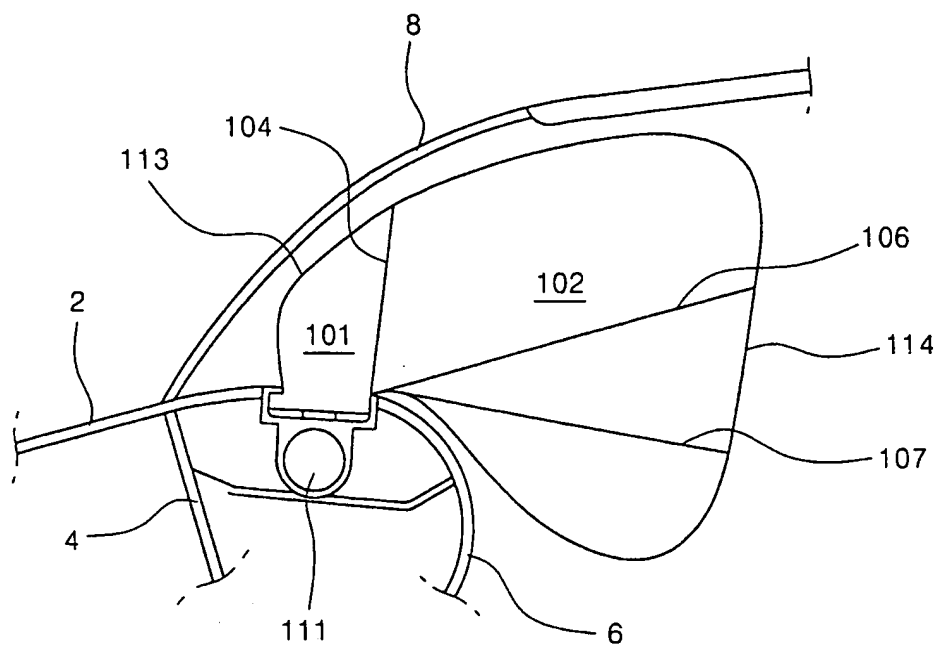


Fig. 4B



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Fig. 4C



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 99/00149

A. CLASSIFICATION OF SUBJECT MATTER

IPC⁶: B 60 R 21/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC⁶: B 60 R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 306 043 A (MIHM), 26 April 1994 (26.04.94), fig.1,2.	1,4
A	GB 2 283 464 A (TAKATA), 10 May 1995 (10.05.95), fig.11,12.	1,4
A	US 5 513 877 A (MAC BRIEN et al.), 07 May 1996 (07.05.96), fig.5,6.	1,4

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

30 June 1999 (30.06.99)

Date of mailing of the international search report

03 August 1999 (03.08.99)

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INTERNATIONAL SEARCH REPORT

Int. national application No. -

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